

US007728904B2

# (12) United States Patent

Quan et al.

### (54) SKIN COLOR PRIORITIZED AUTOMATIC FOCUS CONTROL VIA SENSOR-DEPENDENT SKIN COLOR DETECTION

(75) Inventors: **Shuxue Quan**, San Diego, CA (US);

Chinchuan Andrew Chiu, San Diego, CA (US); Xiaoyun Jiang, San Diego,

CA (US)

(73) Assignee: **QUALCOMM Incorporated**, San

Diego, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35 U.S.C. 154(b) by 942 days.

(21) Appl. No.: 11/402,481

(22) Filed: Apr. 11, 2006

(65) Prior Publication Data

US 2007/0104472 A1 May 10, 2007

#### Related U.S. Application Data

- (60) Provisional application No. 60/734,992, filed on Nov. 8, 2005.
- (51) Int. Cl. *H04N 5/232* (2006.01)
- (52) U.S. Cl. ...... 348/349

See application file for complete search history.

(10) Patent No.:

(45) **Date of Patent:** 

#### References Cited

US 7,728,904 B2

Jun. 1, 2010

#### U.S. PATENT DOCUMENTS

5,907,629	A *	5/1999	Funt et al	382/162
6,249,317	B1 *	6/2001	Hashimoto et al	348/364
2004/0179719	A1*	9/2004	Chen et al	382/118
2005/0207643	A1*	9/2005	Lee et al	382/165

\* cited by examiner

(56)

Primary Examiner—Tuan Ho

(74) Attorney, Agent, or Firm—Timothy F. Loomis; Espartaco Diaz Hidalgo

#### (57) ABSTRACT

The disclosure is directed to techniques for automatic focus control. The automatic focus control techniques prioritize focus of a camera based on skin tone using a skin color detection approach which is intrinsically image sensor-dependent. Sensor-dependent skin color detection to support automatic skin tone prioritized focus control in a camera can enhance the focus of people in the scene. The techniques may be especially useful in digital video camera design, digital still photo camera design, and sensor applications involving people tracking. Sensor-dependent skin color detection is performed once a specific sensor is characterized by taking several raw images of a standard color test target in controlled illumination conditions. Sensor-dependent skin color detection can provide high detection precision and reliability. With sensor-dependent skin color detection, the focus of a camera can be automatically adjusted to prioritize regions of an image containing skin tones.

## 51 Claims, 13 Drawing Sheets (4 of 13 Drawing Sheet(s) Filed in Color)

